

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2015/2016

**TMA1201 – DISCRETE STRUCTURES AND
PROBABILITY**

(TC01 / TC02 / TT01 / TT02 / TT03 / TT04)

11 MARCH 2016
9.00 a.m - 11.00 a.m
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 6 pages (inclusive of the cover page).
2. Answer **ALL** questions. The distribution of marks for each question is given.
3. Please write all your answers in the Answer Booklet provided.
4. Please write the answers for each question on a new page.
5. **NO CALCULATORS** are allowed in this exam.

QUESTION 1: SET, RELATION, FUNCTION, LOGIC**(Total Marks: 10)**

- (a) A relation R is defined on the set of integer, Z where

$$R = \{(x, y) \mid x + y \geq 2\}$$

- (i) Is R a partial order? Justify your answer.

- (ii) Is R a function? Justify your answer.

(2 + 2 = 4 marks)

- (b) Given the predicate,

$$Q(x, y): xy = 1$$

where

$$x \in Z \text{ and } y \in Z$$

Determine the truth values of the following statements. Explain each of your answer.

(i) $\exists x Q(1, y)$

(ii) $\forall x \exists y Q(x, y)$

(iii) $\exists x \forall y Q(x, y)$

(2 + 2 + 2 = 6 marks)

Continued

QUESTION 2: RECURSION, INDUCTION, ALGORITHM (Total Marks: 10)

(a) Given the following mathematical statement:

$$3n \geq (1 + 2n) \quad n \geq 1$$

(i) Show that the inductive base is true.

(ii) State the inductive hypothesis.

(iii) Show that the inductive step is true.

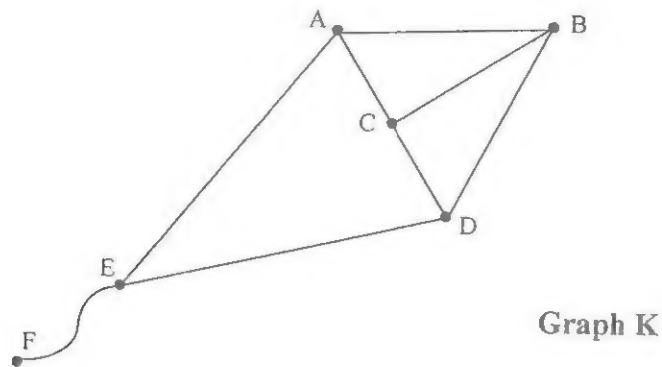
(2 + 1 + 4 = 7 marks)

(b) Show that the average case complexity for $f(n) = 2n^2 + n$ is $\Theta(n^2)$. (3 marks)

Continued

QUESTION 3: GRAPH THEORY**(Total Marks: 10)**

Given the following Graph K,



- (a) Does Graph K have an Euler Circuit and/or an Euler Trail. Explain your reasons by referring to the Euler's Theorem.

(4 marks)

- (b) With vertex A as the root, use the Breadth-First Search (BFS) algorithm to create a spanning tree for Graph K. Note that alphabetical ordering applies.

Use the table format as below:

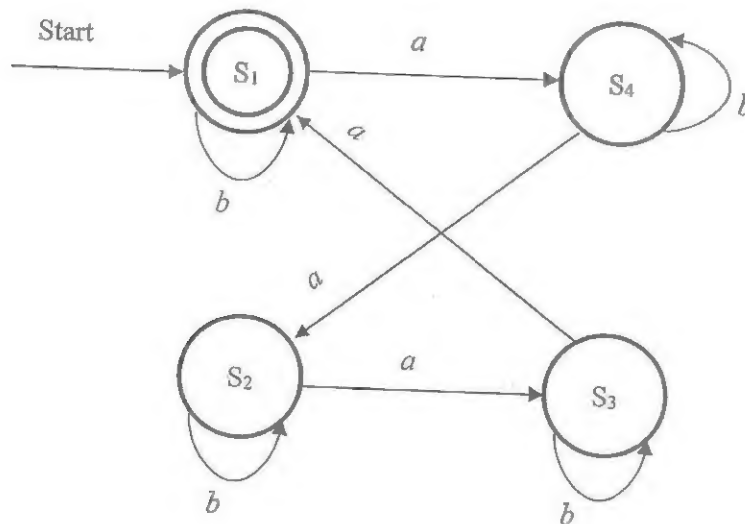
Iteration	Queue	Edges
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(6 marks)

Continued

QUESTION 4: FINITE-STATE AUTOMATA**(Total Marks: 10)**

Given the following state transition diagram for a finite-state automaton, A:



- (a) Create the state transition table for automaton A.
- (b) Will automaton A accept the following input strings?

Input Strings	Decision
<i>a a a a a a</i>	
<i>b b b b</i>	
<i>a b</i>	

- (c) State the language for automaton A.

(5 + 3 + 2 = 10 marks)

Continued

QUESTION 5: COMBINATORICS, PROBABILITY**(Total Marks: 10)**

- (a) Find how many different 6-digits numbers that can be created from the digits below:

3	3	4	5	5	5
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(2 marks)

- (b) Given the following table containing the probability density function (pdf) that describes the revision hours for a group of students in a day at a university:

Duration (Hours) x	0	1	2	3	4	5
$P(x)$	a	a	0.28	0.22	0.20	a

- (i) Find the value of a .
- (ii) Find the expected value, $E[X]$ and $E[2X - 4]$ for the pdf.
- (iii) Given that when students studying more than 4 hours a day is a success, find the probability that in a sample of 10 students, exactly 9 students are doing revision more than 4 hours in a day.

(2 + 4 + 2 = 8 marks)

End of Questions.**End of Page.**